Sleep and Mental Health Among College Students: A Statistical Modeling Approach

Introduction

College students frequently face academic, social, and behavioral pressures that can impact their mental health. Among the key behavioral determinants, sleep patterns—both in duration and quality—have been consistently associated with psychological well-being. The present study explores this relationship using a dataset collected from students at a liberal arts college in the Northeastern United States. Specifically, the analysis aims to address the following research questions:

1. Does sleep duration predict psychological distress (as measured by DASScore)?
2. Which behavioral, academic, and demographic factors best predict psychological distress?
3. Does the effect of sleep on distress differ based on class schedule (i.e., having early classes)?
4. Can clinical depression be predicted using key behavioral and demographic variables?

Dataset and Methods

The dataset includes information from 253 undergraduate students, with 27 variables capturing sleep behavior, academic performance, mood indicators, demographic characteristics, and daily habits. The outcome variables of interest are:
- DASScore: A continuous measure combining depression, anxiety, and stress scores.
- DepressionStatus: A categorical variable identifying students as having normal, moderate, or severe depression; later dichotomized for logistic regression (1 = moderate/severe, 0 = normal).

Variables used in the modeling include:
- AverageSleep (continuous, hours)
- PoorSleepQuality (higher = worse quality)
- GPA (0–4 scale)
- CognitionZscore
- Gender (0 = Female, 1 = Male)
- AlcoholUse (categorical)
- AllNighter (binary)
- LarkOwl (categorical chronotype)
- EarlyClass (binary: 1 = yes)

Exploratory Data Analysis

- The DASScore distribution was unimodal and right-skewed, with a mean of 20.04 and median of 16. The range extended from 0 to 82, with an interquartile range (IQR) of 21.
- The AverageSleep variable was approximately symmetric, with a mean of 7.96 hours and a standard deviation of 0.96 hours.
- There were no substantial outliers in sleep duration. However, higher DAS scores showed a long tail toward extreme values.
- Summary statistics suggested that poor sleep quality varied widely and might contribute to psychological burden, warranting further regression modeling.

Regression Analyses

1. Simple Linear Regression: DASScore ~ AverageSleep

- Coefficient for AverageSleep: –1.42, $p = 0.189$
- Interpretation: A 1-hour increase in average sleep was associated with a 1.42-point reduction in DASScore, though this association was not statistically significant.
- $R^2 = 0.007$: Very low explanatory power using sleep duration alone.

2. Multiple Linear Regression: DASScore ~ Sleep and Other Predictors

Significant predictors of DASScore:
- PoorSleepQuality: $\beta = 2.60$, $p < 0.001$
- GPA: $\beta = 5.24$, $p = 0.032$
- Gender (Male): $\beta = -4.47$, $p = 0.028$

Interpretation:
- Poor sleep quality was the strongest and most consistent predictor of higher DASScore.
- Higher GPA was positively associated with distress, possibly reflecting academic pressure or perfectionism.
- Male students reported lower DAS scores than females.
- AverageSleep, AlcoholUse, CognitionZscore, and AllNighter were not statistically significant in the multivariable model.

Adjusted $R^2 = 0.22$: Approximately 22% of the variance in DASScore was explained.

3. Interaction Model: AverageSleep * EarlyClass

An interaction term between sleep duration and early class schedule was added:

- AverageSleep:EarlyClass interaction: $\beta = -1.33$, $p = 0.52$
- No significant interaction effect was detected. This suggests that the relationship between sleep duration and DASScore did not differ significantly for students with early classes.

4. Logistic Regression: Predicting Clinical Depression (Moderate/Severe)

Outcome: DepressBinary (1 = moderate/severe, 0 = normal)

Predictor	OR	95% CI	p-value
PoorSleepQuality	1.36	[1.21, 1.54]	< 0.001
AverageSleep	1.28	[0.88, 1.91]	0.207
GPA	1.86	[0.74, 4.98]	0.201
CognitionZscore	0.87	[0.51, 1.46]	0.589
Gender (Male)	1.07	[0.49, 2.31]	0.863
AllNighter	0.96	[0.31, 2.68]	0.945
AlcoholUse (various)	NS	—	> 0.5

Interpretation:
- Students with worse sleep quality had significantly higher odds of moderate/severe depression.
- A 1-point increase in poor sleep score increased the odds of depression by 36%.
- None of the other variables were statistically significant in this model after adjustment.

Conclusions

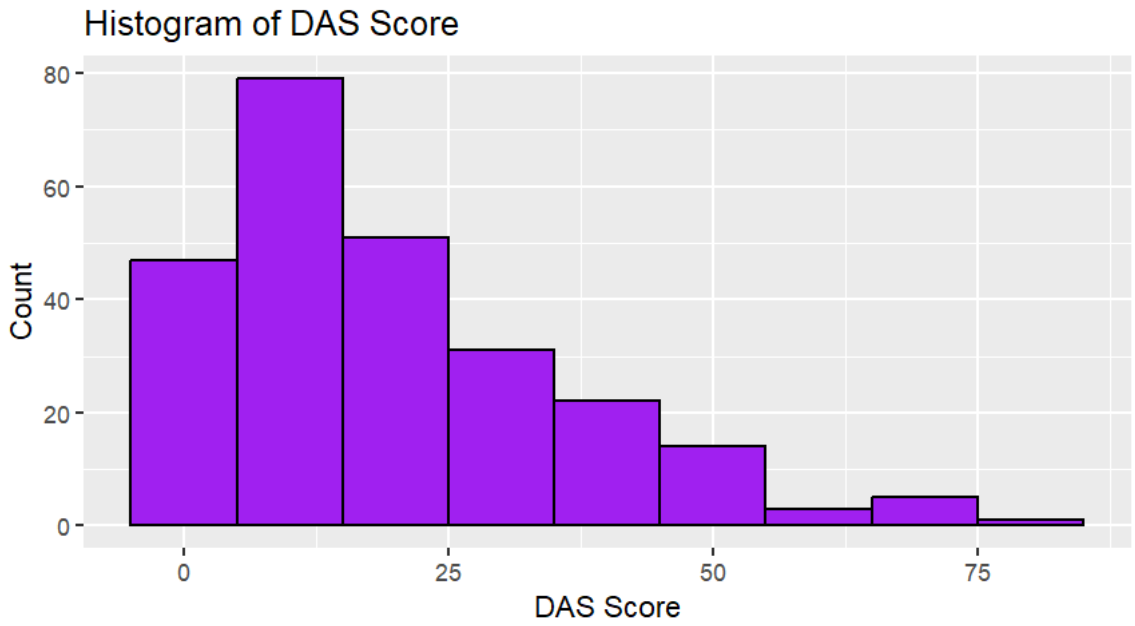
This analysis provides compelling evidence that poor sleep quality is a stronger and more consistent predictor of mental health distress than sleep duration among college students. While average hours of sleep showed no significant association on its own, the subjective quality of sleep was robustly associated with both higher DASScore and greater odds of moderate to severe depression.

From a public health standpoint, these findings reinforce the importance of:
- Incorporating sleep quality screening into college wellness programs
- Providing behavioral interventions targeting sleep hygiene
- Considering mental health risks among high-achieving students reporting elevated GPA and distress
- Focusing less on sleep quantity and more on quality as an actionable point of intervention

Overall, the results suggest that targeted sleep health interventions may play a key role in reducing psychological distress in university populations.

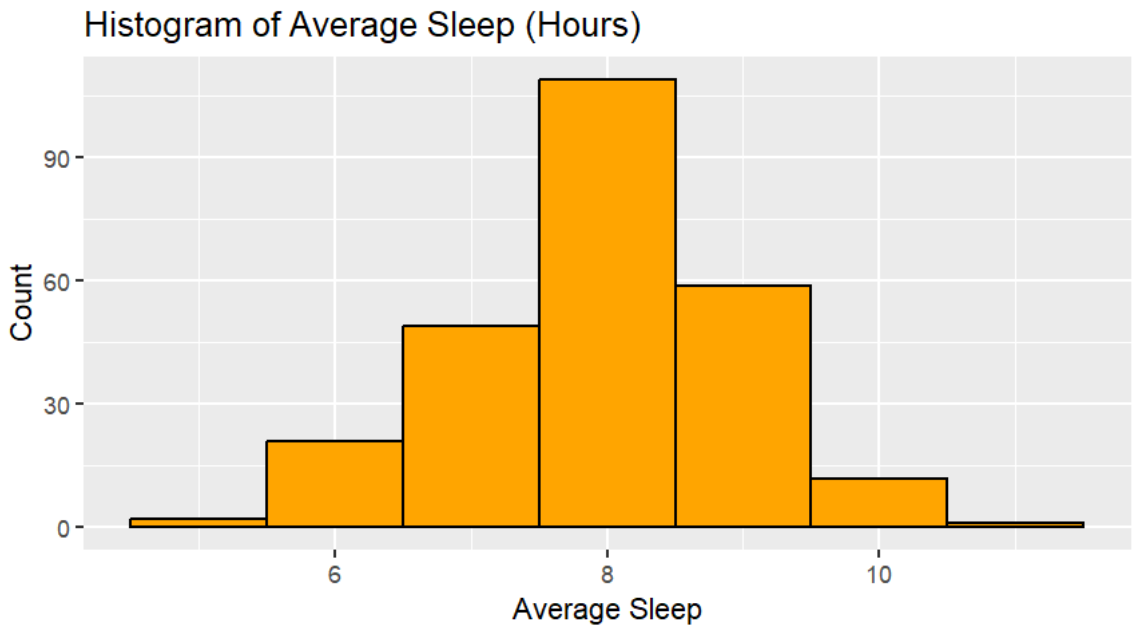
Figures

Figure 1: Distribution of Depression, Anxiety, and Stress Scores (DASScore) Among College Students



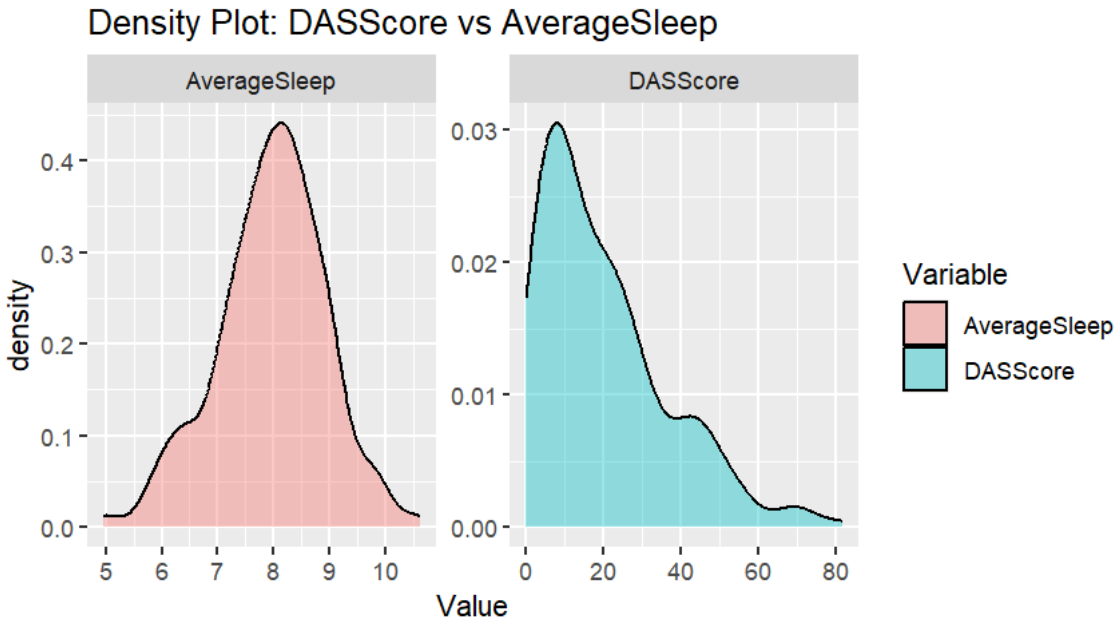
This histogram shows a right-skewed distribution of psychological distress scores, with most students clustered below 30 and a few high outliers.

Figure 2: Distribution of Average Sleep Duration



Most students reported sleeping between 7 and 9 hours per night, with a roughly symmetric distribution centered near 8 hours.

Figure 3: Density Plot Comparing DASScore and Average Sleep



This plot visualizes the distributional overlap between mental health distress and sleep duration, suggesting no strong linear relationship.